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| **SCH4U – Chemical Systems and Equilibrium**  pH and pOH | | **Teachers:** Mr. Jeremy Burt and Mr. Michael Law  **Time:** 75mins | | | |
| **Materials:**   * Lab equipment (beakers, acidic and basic solutions, pH meter) * Projector, screen, and laptop | | **Appendix:**  I. Element Cards  II. Placemat Design  III. PowerPoint  IV. Traffic Lights | | V. Handout  VI. Teacher Notes  VII. Teacher Notes  VIII. Triangles reflection | |
| **Curriculum Connections:**  **Big Idea:**  Chemical systems are dynamic and respond to changing conditions in predictable ways  **Overall Expectations:**  A1 Demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analyzing and interpreting, and communicating)  E3 Demonstrate an understanding of the concept of dynamic equilibrium and the variables that cause shifts in the equilibrium of chemical systems.  **Specific Expectations:**  A1.1 Formulate relevant scientific questions about observed relationships, ideas, problems, or issues, make informed predictions, and/or formulate educated hypotheses to focus inquiries or research  A1.13 Express the results of any calculations involving data accurately and precisely, to the appropriate number of decimal places and significant figures  E3.5 Use the ionization constant of water (Kw) to calculate pH, pOH, [H3O+], and [OH–] for chemical reactions  **Learning Goals:**  By the end of the lesson, students will be able to understand and use Kw, pH, pOH, [H3O+], and [OH–] for chemical reactions as well as to understand their relationships to one another. Students will also be able to understand and complete simple strong acid-strong base neutralization reactions.  **Prior Knowledge:**  SNC1D: Atoms, Elements, and Compounds (families of elements)  SNC2D: Chemical Reactions (pH scale)  SCH3U: Chemical Reactions (neutralization reactions), Quantities in Chemical Reactions (stoichiometry) | | | | | |
|  | **T/L Strategy** | | **Rationale** | | **Assessment** |
| **Minds On**  5mins  Appendix I  (element cards)  10mins  Appendix II (placemat design) | **Whole Class 🡪 Randomization of Groups**   * Students given card with one of elements #1-30 printed on it * Students must group themselves according to elemental family (alkali metals, alkaline earth metals, transition metals, other metals, non metals, halogens, noble gases) * Larger groups divided such that groups no bigger than 3-4 students   **Groups of 3-4 🡪 Placemat**   * Students independently write down everything they know about acids, bases, neutralization reactions, pH etc * Main points summarized in Placemat via group discussion * Several groups present main point to entire class without overlap | | * Engage students with interactive activity * Refresh knowledge of first 20 elements * Assess prior knowledge and readiness * Activates prior knowledge for use in today’s class * Lack of overlap ensures students are listening and focused | | AfL   * Circulate to monitor group correctness   AaL   * Students determine who belongs in which family   AfL   * Circulate and monitor placemats to locate gaps in required knowledge |
| **Action**  15mins  Appendix III (PowerPoint)  Appendix IV  (traffic lights)  15mins  Appendix V  (handout)  15mins  Appendix VI  (Teacher Notes) | **Whole Class 🡪 PowerPoint Presentation**   * Review concepts of pH, pOH, [H3O+], [OH-], strong acids and bases, neutralization reactions * Groups given set of red, yellow, green cards (green = I understand, red = I don’t understand)   **Groups of 3-4 🡪 Jigsaw with Handout**   * Each student in group completes three questions from worksheet * Students must teach questions to group members and vice versa   **Whole Class 🡪 Demonstration**   * Beakers of strong acids and bases displayed on bench with labels * Students calculate theoretical pH using given concentration and volume * Actual pH measured via pH meter * Class discussion on discrepancy between theory and practice | | * Allow students to construct new knowledge * Allows students to troubleshoot peers’ work * Allows students to make connection between theory and practice * Allows students to realize that predictions ≠ results sometimes | | AfL   * Traffic lights determine pace of lesson and depth of explanation   AaL   * Students reflect on learning through teaching |
| **Consolidation**  15mins  Appendix VII (Teacher Notes)  Appendix VIII  (Triangles Reflection) | **Whole Class 🡪 Demonstration**   * Strong acid added to strong base * Students in groups calculate theoretical pH using given concentration and volume with stoichiometry   **Individual 🡪 Triangles Reflection**   * Students fill out and submit sheet before being dismissed | | * Allows students to make connection between theory and practice * To highlight the big ideas * To reflect on learning | | AaL   * Triangles as ticket out of class |
| **Next Steps** | **Individual 🡪 Question Design**   * Create 3 sample questions with full solutions of varying difficulty (easy, medium, hard) * Class notes, textbook, internet, etc to be used as resources | | | | |